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ABSTRACT

This literature review focuses on methods for determining collection development requirements of a university library. Five criteria were used in the selection of titles for review: immediate relevance to university library collections and allocations; degree of emphasis on empirical methodologies; publication dates within the last 10 to 15 years; ease of access; and indexing in "Library Literature." Consideration of each of the following topics includes a summary of relevant thought and indicates the appropriate citation in the bibliography: Allocation by Formula; Selectivity, Adequacy and Collection Evaluation; Formula Factors; and Efficiency/Equity. (Author/JAB)

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ACADEMIC LIBRARY MATERIALS:

BUDGETING AND ALLOCATION

(A review of the literature)

by

Gary M. Shirk

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ACADEMIC LIBRARY MATERIALS:
Budgeting and Allocation
(A review of the literature)

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October 1976

Introduction

Briefly stated, the subject of the review is the literature pertaining to methods for determining collection development requirements of a University Library. The question of allocation of funds was seen as a special case of the more general problem, i.e. the sum of the requirements of the parts, modified by the effects of their interdependence, is the requirement of the whole.

The literature of collection development is large and diverse. Due to time constraints it was necessary to severely restrict the scope of the review. The selection of titles for review was based on the following criteria:

1. Immediate relevance to university library collections and allocations.
2. Degree of emphasis on empirical methodologies.
3. Publication dates of the last 10 to 15 years.
4. Ease of access.
5. Indexed in Library Literature or in bibliographies of articles indexed in it.

Trends and Topics

Judging from the number of relevant titles within the temporal scope of the review, the profession has become increasingly interested in empirical solutions to the problem of determining collection needs and allocating resources. The greatest weakness of the literature is the lack of a coherent theoretical framework within which to judge the research that has been done, to define the significant questions in the area, and to guide future research. There are suggestions of "meta-theories" borrowed from other fields in Gold (13) or Kohut (18, 19). However, no thorough conceptual framework of the area turned up during the search.

Terminology is so diverse and methodologies so widely variant that it was impossible to simply extract a set of topics from the content of the literature. So, probably contributing to the problem, here are a set of "abstract" topics:

1. Allocation by Formula
2. Selectivity, Adequacy and Collection Evaluation
3. Formula Factors
4. Efficiency/Equity

Each of these topics will be considered separately, summarizing relevant thought and indicating the appropriate citations in the bibliography.

Allocation by Formula

For most large academic libraries, budgeting and allocating by department or subject libraries is not a choice to be made but a painful fact of life. It is not surprising that library literature includes increasing numbers of articles relating to this aspect of library budgeting. Writing in 1963, McAnally (25) concludes that library budgets would receive more attention in future years and emphasized budgets based on empirical data and true needs. Some later writers express the objective of making explicit what is already being done (Kohut - 18, Revill - 36), while others proclaim the need for simple, sensible and systematic solutions (Revill - 35, McGrath - 29, McAnally - 25). These and other authors reflect the growing uneasiness with traditional methods of distributing library materials among departments or subjects and are leading efforts to do what some of us have called "rationalizing the materials budget."

William McGrath, one of the most prolific writers in this area, outlines three decisions possible for librarians who must allocate materials funds (McGrath - 26):

"1. Emphasize and build one or more departments or divisions to the neglect of others;
2. Assert no control and let a library collection develop where it may;
3. Emphasize all areas, fairly and equitably."

He recommends an empirically based formula to distribute funds efficiently, which he believes reflects the third and best decision. Allen (1), however, reminds us that formula budgeting is only one of several budgeting methods:

1. Traditional budget: based entirely or primarily on objects of expense.
2. Program budget: based primarily on the program of work and somewhat less on the object of expense.
3. Performance budget: based primarily on statistically measurable performance of activities and work progress.
4. Planning, Programming, Budgeting Systems (PPBS): based on applications of both Program and Performance approaches to identify objectives and selecting alternatives for attaining these.
5. Formula budgeting: based on quantitative models and "setting numeric guidelines for fund allocations as relative to pre-established standards or adequacy and accepted levels of attainment."

Fundamentally, formulas are merely a means of relating allocations to one or more variables presumed to be pertinent (Summers - 41). The relationships among independent variables that determine the value of the fund allocation constitute a pre-established standard that can be used for both budgeting and analysis (McAnally - 25). Standards such as "Libraries should have one reference librarian per 1000 students" presume a relationship between reference librarians and students that could be formulized by $RL = \frac{\#\text{ of Students}}{1000}$.

Although the use of formulas is not new to libraries, their popularity has increased dramatically since the Clapp/Jordan (9) formula for minimal adequacy appeared in 1965. Several authors have explained the reasons for the appeal of formulas (Allen - 1, Summers - 41):

Formulas...

1. Reduce paperwork in budget process,
2. Eliminate extraneous details,
3. Facilitate inter-institutional comparisons,
4. Facilitate comparisons from year to year,
5. Connote mathematical infallibility,
6. Require fewer budgeting and planning skills to prepare and administer,
7. Provide governing bodies with a sense of equity because each institution in the system is measured against the same criteria.

Perhaps, Burton (8) best sums up formula budgeting's attractiveness: "The apparent ease, economy, and simplicity of plugging in a few figures and getting a completed budget instantly is hard to resist." More institutions are succumbing to the lure of this approach each year, ignoring more difficult budgeting processes such as PPBS (Allen - 1).

However, formula budgeting is not without its detractors. The most common criticism of formulas is that they tend, despite sometimes sophisticated mathematics, to be fundamentally arbitrary (e.g. Brophy - 6). The real decisions, such as the weighting of factors, are subjectively derived or based on weak theoretical grounds. Frequently, formulas are adjusted to head off political repercussions (Summers - 41) or, in efforts to "let the chips fall where they may," are designed in ignorance of their distributional impacts (Bonnen - 3). Most writers totally overlook the need to identify specific requirements of the collection and to plan, perhaps over several years, to satisfy them (Schad - 37).

Although no one has articulated a comprehensive and coherent theoretical framework, several approaches to the development of an allocation formula have been taken. As early as 1961, McAnally (25) classified these attempts into four categories:

1. Arbitrary standards: authoritative opinion used to establish a base, e.g. 5% of the Research and Instruction budget of the University.

2. Enrollment bases: establishment of funding patterns based simply on the number of students enrolled, e.g. $30 per student.
3. Comparisons: comparisons with current budgets of other institutions or past budgets of the same institution.
4. Unit-Cost Bases: determination through analysis of each activity's unit costs, prediction of the number of new units required and budgeting accordingly.

Brayell (4) expands the comparison approach to statistical medians and means. Kohut (18) assumes optimum distribution and derives a method to maintain the equilibrium between departmental allocations and between serials and monographs during periods of inflation. Schad (37) emphasizes the need for a planning approach, recognizing the desirability of charting the direction for the collection. Gold (13), an economist, argues for a cost/benefit approach, while SUNY (42) urges the development of a discipline based formula.

The proliferation of approaches reveals the confusion now existing in the area and helps to explain the diversity of available formulas, the number of dissatisfied critics, and the equal number of wounded backers. Here's an assortment of formulas gleaned from the literature:

1. Volume Entitlement (Allen - 1):

	Clapp-Jordan	Wash.	Florida	Calif. St.
Basic or "opening day" collection	50,750	85,000	85,000	75,000
Per FTE faculty	100	100	100	
Per FTE student	12	15	15	*
Honors undergraduate	12	0	0	0
Undergraduate major in subject field	335	0	0	0
Per masters field (terminal)	3,050	6,100	7,500	3,000
Per masters field (with PhD)	0	3,050	**	0
Per PhD	24,000	24,500	15,000	5,000

*California State Formula provides for increasing of collection for each 200 students over a floor of 600 by 10,000 volumes.

**Florida eliminated the recommended resources for non-terminal masters programs. It was thought that where the doctorate was the terminal degree, the resources provided could support the lower level program.

Note: McInnis (31) attempts to overcome the arbitrary basis of the Clapp/Jordan formula by doing regression analysis on data collected from 36 U.S. universities with successful Ph.D. programs. Theoretical weaknesses such as failure to define "adequacy" satisfactorily mar an otherwise interesting analysis of comparative data.

2. Book Index Formula (Lyle - 22):

$$\%\,\text{Allocation} = \frac{A + B + 2C}{4}$$

where...

$$A = \frac{\text{Faculty in Dept. in FTE}}{\text{Total Faculty}}$$

$$B = \frac{\text{Course Load of Dept.}}{\text{Total Course Load}}$$

$$C = \frac{\text{(Students x Credit Hours) for Dept.}}{\text{Total (Students x Credit Hours)}}$$

3. Book fund allocation formula (Revill - 35):

$$\text{Lib. \$} = M + Fw\,(B + \frac{110}{100}\,P)\,\sqrt{(N)\,(a)\,(F)}$$

where...

Lib. $ = total allocation to site library
M = a minimum allocation per site
Fw = weighted percentage of students served (Fw = $\frac{\text{Dept. FTE Student}}{3 \text{ or } 4}$, divide by 3 for humanities students, 4 in sciences. Then convert to a percentage of the total weighted FTE students.)
B = Total Book Fund less (M per site 110% periodicals budget + sum of square roots)
N = Total previous year's titles published
a = average price of those items
F = Total FTE students by Delaney or accommodation formula.

4. An Allocation Formula derived from a factor analysis (McGrath - 26):

$$A_d = \frac{E}{N} + (W_1 F_{1d} + W_2 F_{2d} + W_3 F_{3d} + \ldots) \cdot (T - E)$$

where...

A_d = Allotment for individual department
E = Amount to be divided equally
N = Number of departments
F = Fraction of the variable (Factor) contributed by department (d)
T = Total amount to be divided
W = Arbitrary weighting value for each factor (Sum of F_d = 1.00)

5. Book Funds (Burton - 8):

Book funds = (Weighted Users x Monographs needed per weighted User x average cost per monograph) + (Weighted Users x Serials needed per Weighted User x average cost per serial) + (Volumes to be Bound x average Cost per volume to be bound).

6. Beasley's Formula, 1968 (Bonn - 2):

$$\text{Potential Service} = \frac{B}{P} \times \sqrt{\frac{C}{P} \cdot S}$$

where...

B = all resource material, perhaps weighted
P = population served
C = circulation
S = study or research factor (which could be arbitrary)

Note: The intention would be to allocate in order that overall potential service would be increased.

This section has attempted to give an overview of current thought on formulas for the budgeting, analysis, and allocation of book funds. Formulas are basically developed to provide a simple, efficient and explicit method of allocating funds among competing activities. Unfortunately much of what appears to be sound, empirical rationalization frequently rests on subjective assumptions or "after-the-fact" political adjustments which may eliminate any value the approach might have (Summers - 41). The next three sections of the review will explore in more depth problems suggested by the formula approach: Selectivity, Adequacy, and Collection Evaluation; Formula Factors; and Efficiency/Equity.

Selectivity, Adequacy and Collection Evaluation

Although the assumption is rarely made explicit, most writers on allocation formulas assume a uniformly high quality of materials selection. Generally this assumption is made to simplify the allocation problem, but it may sacrifice validity in the process. McGrath (26-30) questions the assumption and notes the interrelationship of selection, collection evaluation, and allocation. However, many others in the profession (Clapp - 9, Kraft - 20, Schad - 37) reject "use" as too narrow a dimension with which to tie them together. Despite severe budgetary pressures and the example of a single dimensional approach to the analysis, no one has yet rigorously defended a multi-dimensional analysis of their inter-relationships.

Though the profession has long been acquainted with selection, its role in the allocation problem is probably the least understood. McGrath (29) attempts to focus on the problem by outlining two types of acquisitions philosophies:

1. Critical: This philosophy guides selection based on criteria of excellence alone and does not permit quantitative data to override sound professional judgment.
2. Demand: This philosophy gives credence solely to quantitatively expressed demand, overriding any criterion of excellence.

McGrath himself prefers the exercise of critical judgment to select materials in areas where empirical demand is shown. This view runs counter to traditional academic library acquisitions philosophy, which urges large, comprehensive collections designed to meet actual and potential research needs regardless of current demand.

McGrath (29), who uses the dimension of "use" correlated with subject classified department, offers the following result for collections developed using his method: "If a librarian is successful, the collection will be 'well balanced,' not just in the sense that all the traditional and classic subjects and titles are represented, but in the sense that books are owned in each subject in proportion to the volume of demand or need."

Margit Kraft (20) approaches the problem from a different angle. She argues convincingly that the desirability of gigantic collections should be reevaluated. She systematically perforates traditional arguments that research libraries...

1. must ideally be complete and comprehensive,
2. collect not only for the present but also for the future, and
3. possess collections that never become obsolete.

Although she does recognize the potentially beneficial results of smaller, better focused collections in reducing costs of collection housing and maintenance, she does not draw links between better selectivity and the allocation process, nor does she define carefully a method to measure selection quality.

Most of us can easily understand the threat to library collections from reduced budgets or budgets eroded by inflation, but are tighter acquisitions policies also a threat? Arguments for greater selectivity are based on the belief that better selection would enable libraries to reduce the number of purchases without significantly damaging the collection's ability to serve its clientele. Fundamental to this belief, whether or not it is expressed, is the notion of "adequacy," a sort of lower limit of collection usefulness. Much of what we call "standards" are in fact estimates of "minimal adequacy," which are most effective when linked to the loss of something valuable such as accreditation or important faculty (Summers - 41).

The Clapp/Jordan formula (9) was originally intended to be a method for estimating the size for "minimal adequacy" of academic libraries. Their notion of adequacy was quite simple: scholars create specific book lists whose sum defines the adequacy of the whole. In 1972, McInnis (31) -- attempting to validate their formula -- offers an operational definition: "adequacy" is defined by the nature of the collection of those 36 major universities with

successful Ph.D. programs. In neither of these cases -- nor any other article in this review -- has "adequacy" been carefully and rigorously defined.

Ultimately, determining "adequacy" is a function of collection evaluation, which is--in effect--an evaluation of selection methods, acquisition policies and procedures (Bonn - 2). Collection evaluation, however, is rarely linked directly to the allocation process (but see Schad - 37, SUNY - 42) despite what now appears to be its critical role in the development of selection guidelines.

Bonn (2) reminds us that evaluation must take account of the library's goals in the context of the parent organization and must include a test of the library's ability to provide the required documents. He offers the following summary of collection evaluation methods:

1. compiling statistics on holdings, use, expenditures.
2. checking lists, catalogs, bibliographies.
3. obtaining opinions from regular users.
4. examining the collection directly.
5. applying standards, plus testing the library's document delivery capability and noting the relative use of several libraries by a particular group.

Methods for collection evaluation now being developed in light of the library materials budgeting problem may have impact on allocation formulas. Dillehay (10) and SUNY (42) recommend examination of the literature of a discipline as a factor in allocation. Brayell (4) emphasizes the need for comparisons between collections of similar institutions while McGrath (30) links usage to specific curriculum related subjects. Fussler (12) and Simon (39) study patterns of book use in large research libraries, which seem to indicate that titles decline in value to the clientele rapidly at first then level off. Kantor (15 and 16) and Schofield (38) have devised methods to study library performance that attempt to integrate collection acquisition with cataloging efficiency, user failure, and ultimate satisfaction. Studies of statistical phenomena such as the Bradford-Zipf distribution (Brooks - 5, Fairthorne - 11, and Leimkuhler - 21) have already influenced the design of information retrieval systems and may have implications for larger, more diverse collections such as those of research libraries.

Further research and study is needed to explore the interrelationships of collection evaluation, adequacy, and degree of selectivity. Following this, efforts should be made to understand more fully their role in public service patterns and overall clientele satisfaction.

Formula Factors

Basically a formula asserts a specific relationship between factors. Frequently these relationships are expressed in the form of a simple mathematical equation whose left member is the "dependent variable" and whose right member is composed of one or more "independent variables" whose interrelationships are expressed mathematically. McGrath's formula,

$A_d = \frac{E}{N} + (W_1F_{1d} + W_2F_{2d} + W_3F_{3d} \ldots) \cdot (T - E)$ is a fine example. It may be useful then to discuss formula factors in terms of these two categories: Dependent Variables and Independent Variables.

Dependent Variables

A percentage of the given total budget for materials, expressed in dollars, is the most common dependent variable (McGrath - 26 and 29, Revill - 35, Gold - 13, Burton - 8, etc.). Brayell (4) compares actual budgets at different institutions to establish a funding level while McGrath (27) estimates the level from a determination of required materials and their costs. Kohut (18) advocates a different approach: the use of a "resource unit" as defined by the U. S. Office of Education in its Annual Higher Education General Information Survey as a dependent variable. He argues that differing ratios of monographs to serials and inflation rates from subject to subject makes it desirable to guide collection development via these units. Yovits (46) and Whittemore (45) have attempted the precise definition of a unit of information for use in information science which may have important effects on the conceptualization of a "resource unit" for libraries.

Independent Variables

Fluctuations in recommended independent variables are believed to determine variations either in the ability of the collection to perform adequately or in the level of total financial support required. The literature presents a dazzling array of such independent variables, frequently without any logical or empirical justification. The lack of justification can be explained in part by a failure of the profession to create a viable scale of collection adequacy against which variations in independent variables can be measured.

Listed below are several categories of independent variables which have been used in formulas, or recommended as descriptors of departmental or subject area need:

1. Demand: Most writers tend to see circulation as the most reasonable indicator of need or demand. Schofield (38) develops the concept of items "consulted" to include both internal and external circulation while McGrath (29), building on results of Fussler (12), finds them so highly correlated that external circulation may adequately represent all forms of consultation. In addition to its use as an expression of current needs, Trueswell (43) uses circulation as a predictor of future demand to determine remote storage plans; Brayell (4) uses circulation volume to determine need for added copies; and McGrath (3) measures selection performance with it in conjunction with a profile of the curriculum.

2. Library Materials: Many writers believe that variables relating to the collection itself should play an important role in determining the

level of support. To achieve intellectual balance, the University of Florida has created an allocation factor, "depth of field," which measures the extent to which their collection matches the distribution of monographs held by the Library of Congress (Kebabian - 17). Kohut (18), on the other hand, stresses the importance of maintaining the optimum ratio between monographs and serials, while the Wellesly College adjusts their formula's results by considering past expenditures by subject (Lyle - 22). McInnis (31) attempts to include a factor of proximity to other library collections, and--very recently--SUNY (42) recommends the use of factors such as the evaluation of the extant collection, external cooperative arrangements, dispersal of holdings, physical form of materials, and materials loss or deterioration.

3. Clientele: The formula factors most familiar to us are those related to the primary clientele of the academic library--faculty and students. Variables such as enrollment, faculty size, and units of instruction appear in the earliest formulas (Lyle - 22). They have been used with some success from Clapp/Jordan (9) to Allen (1). More recently, McInnis (31) has added faculty "commitment of research" and "methods of instruction." Gold (13) attempts to develop a concept of "marginal benefit" to each department by creating a weighted function of "student hours taught" and "circulation use by course." McGrath (28 and 30) argues that the subject of material must be considered to enable proper support for small teaching departments whose disciplines have wide interest among the clientele of other departments.

4. Discipline and Publication Environment: SUNY (42) stresses the importance of a discipline oriented formula which recognizes the need of each academic discipline to the best published material in its area, regardless of fluctuations in enrollments. This relationship to publishing has long been recognized. Dillehay (10) creates a profile of the literature in a field for use with her formula. McGrath (29) asserts that use, when correlated to subject areas gives the clearest picture of academic interests at an institution. Almost all writers recognize the importance of the number and price of publications (McGrath - 27 and 26, Burton - 8, Lyle - 22, Revill - 35, etc.)

5. Weighting of Factors: The Clapp/Jordan formula was one of the earliest to systematically employ weighting to indicate varying degrees of importance given to factors in allocation formulas. Since that time weighting has played a major role in many formulas (Burton - 8, McGrath - 26, Goyal - 14, Allen - 1, etc.). Usually such weights are given to vary the impact of faculty use over that of graduate students or undergrads; McGrath (26) urges the use of weighting factors with "circulation" and "citations" by subjects.

The attractiveness of simple, mathematical formulas to efficiently and equitably distribute materials funds is damaged by accusations of arbitrariness.

Borphy (6), for example, attacks Revill's formula (35) because it rests on vague judgmental decisions, reducing the mathematics to a vacuous exercise. Revill (36) defends the formula on the basis that it makes explicit what judgments are, in fact, being made. Even McGrath (26) who incessantly emphasizes the importance of empirical "facts" relies upon value judgments to complete his formula. Gold (13) and Goyal (14) depend upon "importance" judgments to tie together sophisticated concepts in economics and operations research respectively. Kohut (19) delves into political economics to defend his assertion that to approximate an equitable distribution "explicit decisions" (value judgments) are required. Allocation formulas alone may therefore be inadequate to guarantee distributional equity.

Efficiency/Equity

Most writers on allocation formulas assert that their fundamental purpose is to achieve an efficient and equitable distribution of funds for library materials. But has the profession explored either "efficiency" or "equity" sufficiently? Gold (13) accused Kohut (18) of ignoring "economic efficiency," i.e., equalizing marginal benefits with marginal costs. Kohut (19) retorted that the central problem for libraries was not "economic efficiency" but rather "welfare economics", the evaluation of the distributional impacts of fund allocation. Although both of these issues are sometimes addressed in library literature, neither appears to be well understood. The purpose of the following discussion is merely to outline the dimensions of the discussion, not to fully explain the issues.

The basic requirement of economic efficiency is to select activities whose benefits equal or exceed their costs. In terms of the allocation of library materials the problem becomes one of balancing the benefits of each additional resource unit (marginal benefit) with each additional unit of costs (marginal costs). Estimates of marginal benefits, however, are far more difficult (Kohut - 19 gives a good discussion). Political economists themselves have not agreed on how these estimates can be achieved for governmental programs. The usual method is to give benefits a "shadow price", the price a user would pay if the service were part of a free market (Margolis - 24, McKean - 32). This method has been severely questioned (Mack - 23, Weisbrod - 44) as the sole vehicle upon which to make public decisions.

Mack (23) recommends the development of a measure for benefit that is based on direct consideration of value rather than shadow prices. Although the possibility of a direct measure of value may seem remote for the marginal benefits of library materials, wider investigation of the Bradford-Zipf distribution (Brooks - 5) may prove fruitful. The basic concept governing the effects of this distribution is that each addition to the total decreases in its value to the total, i.e., the addition of one monograph to a collection of 20 is of greater value than the addition of one monograph to a collection of 2000.

Whereas economic efficiency requires the selection of activities whose benefits at least equal their costs, equity is primarily concerned with dis-

tributing benefits fairly. Thus, an activity whose cost is high relative to its benefits may be chosen over another activity whose benefits equal costs if the benefits accrue to the proper groups. Weisbrod (44) attempts to integrate both efficiency and equity by weighting the cost/benefit index with distributional factors derived from past decisions. However, this approach cannot avoid the problem with expressing benefits (both measurable and non-measurable) along a single dimension, e.g. money. Steiner (4) recommends a multi-dimensional objective structure which measures those factors that can be confidently measured and leaves "intangibles" to explicit decision.

Recognizing what is perhaps the unavoidable problem of imperfect measures of cost/benefit analysis, Mack (23) recommends a usefulness test:

1. Comprehensiveness: percentage of total benefit the methodology adequately calibrates.
2. Capacity to uncover, focus and steady the aspects of total benefit it fails to calibrate.
3. General acceptability.
4. Power to improve administrative or legislative action because of ability to focus discussion on notions of public benefit.

Bonnen (3) considers the appraisal of distributional impact just as critical and suggests a list of questions intended to generate information needed to estimate that impact.

Steiner (40) concludes with probably the most sensible statement about the problem of efficiency and equity relations: "There is a role for measurement, a role for analysis and some need for explicit decision making.... The advantage of articulating real choices over assignment measures that appear to obviate them is to make the decision explicit and subject to review."

Summary and Conclusion

The literature concerning the determination and allocation of funds for academic library collections is large and diverse. The issues and problems it presents are complex, intricate, and unresolved. The literature reflects the complexity of the allocation problem itself and explains, to some extent, the attractiveness of a simple, efficient, mathematical formula.

This review has attempted to outline the current status of professional thinking about materials budgeting and allocation. The first section summarizes the basic reasons for the development of formulas, outlines their major elements, and gives a few examples. The remaining three sections explore in some depth three related areas of concern: Selectivity, Adequacy, and Collection Evaluation; Formula Factors; and Efficiency/Equity.

For the most part, important concepts in the area such as "adequacy" and "resource unit" remain poorly defined and have not been integrated into any

coherent theoretical framework. McGrath (29) probably sums up the current status of the field better than anyone else:

> "Whereas in previous years many allocation formulas were contrived to appease faculties, library committees, or boards, now these formulas must make sense. They must be based on sound theory backed up by empirical data. The difficulty is that no such theory has yet been presented."

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